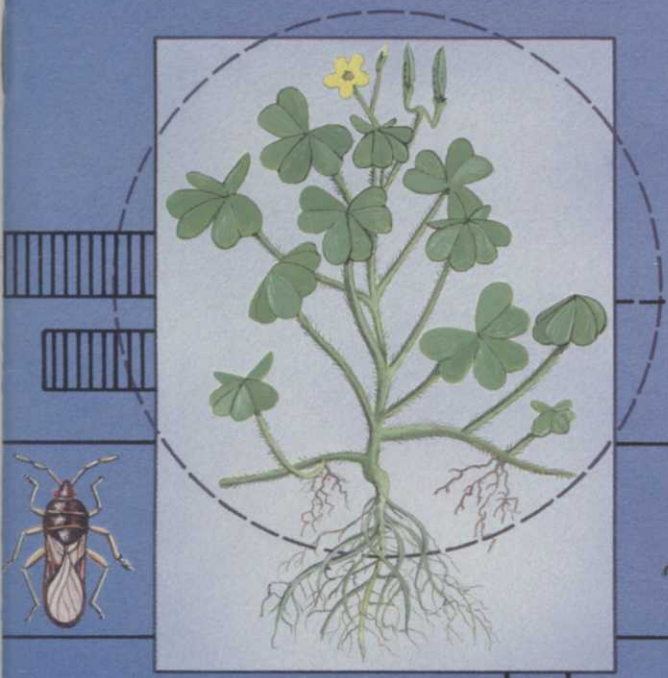
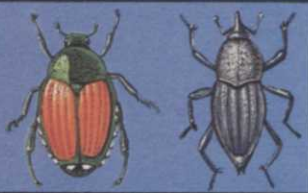
LANDSCAPE MANAGEMENT

PART 2

POCKET GUIDE





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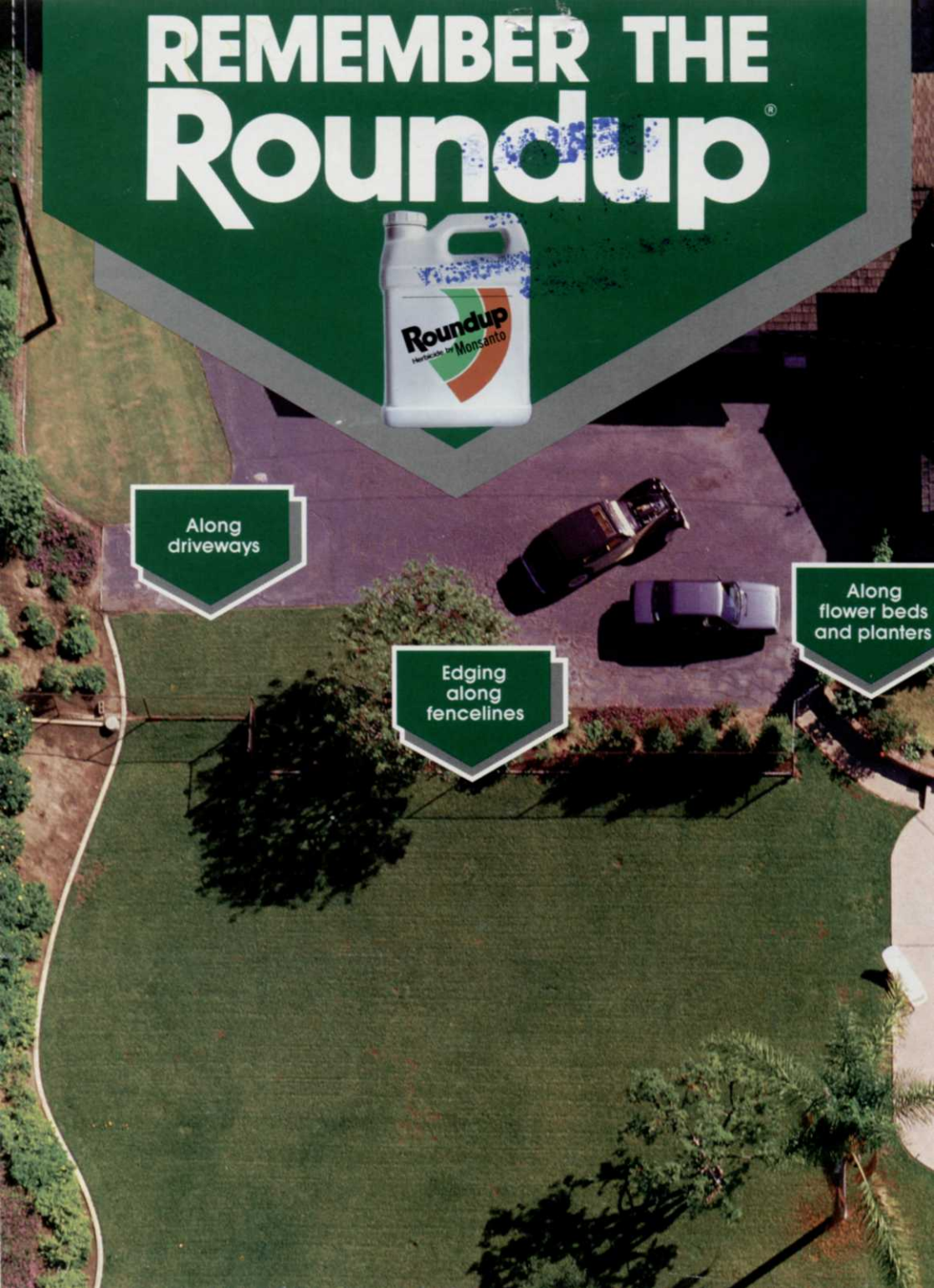
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Roundup®
Roundup
Herbicide by Monsanto
Along driveways
Edging along fencelines
Along flower beds and planters

Now's the time to Remember ROUNDUP® herbicide for all kinds of jobs around the customer's lawn. Remember that ROUNDUP controls a broad spectrum of weeds, roots-and-all. With no time wasted on retreatment, you'll have more time for new business.

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Always read and follow the label for Roundup® herbicide. Roundup® is a registered trademark of Monsanto Company. © Monsanto Company 1989
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For complete information on the many benefits of trimming and edging with Roundup, call

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WEED CONTROL

COOL-SEASON

by Thomas Watschke, Penn State Univ.

Cool Season Herbicides

Herbicide	Brand Name(s)	Company	Uses
ammonium sulphanate	Ammate	DuPont	Non-selective rights of way herbicide
asulam	Asulox	Rhone Poulenc	Post-emergence grassy weed control for turf and ornamentals
atrazine	Aatrex	Ciba Geigy	Non-selective control in non-crop areas.
benefin	Balan	Elanco	Pre-emergence control of annual grasses and broadleaf weeds in established turf.
bensulide	Betasan Pre-San Lescosan Betamec-4	ICI Sierra Lesco PBI Gordon	Pre-emergence control of annual grasses and broadleaf weeds in established turf and established flower gardens. Safe near tulip and daffodil bulbs.
bentazon	Basagran	BASF	Selective post-emergence control of nutsedge in warm-season turf.
bromacil	Hyvar	DuPont	Non-selective control of weeds amd grasses on non-crop areas. Usually mixed with diuron for roadsides and rights-of-way.

continued . . .

Cool Season Herbicides (cont.)

Herbicide	Brand Name(s)	Company	Uses
bromoxynil	Buctril	Rhone Poulenc	Post-emergence control of broadleaf weeds in seedling turf, established turf and non-crop areas.
cacodylic acid	Phytar Rad-E-Cate	Vertac Vineland	Non-selective control for turf renovation, edging and in plant beds.
chloramben	Amiben	Rhone Poulenc	Pre-emergence control in ornamentals.
chlorflurenol	Maintain	Uniroyal	Growth regulator. Also controls broadleaf weeds and vines.
copper	Cutrine-Plus	Applied Biochemists	Control algae, chara and hydrilla in potable water.
dalapon	Dalapon 85 Dowpon M	Fermenta Dow	Selective control of perennial and annual grasses in non-crop areas and ditchbanks.
dazomet	Mylone	Hopkins Ag.	Preplant sterilant for turf and ornamental beds.
DCPA	Dacthal	Fermenta	Pre-emergence control of annual grasses and broadleaf weeds in turf and ornamental beds.
dicamba	Banvel	Sandoz	Selective post-emergence control of broadleaf weeds in turf and for non-crop control of brush.
dichlobenil	Dyclomec	PBI Gordon	Selective weed control in ornamental beds and for total weed control on roadsides, fencerows, etc.
dichlorprop	2,4-DP	Rhone Poulenc	Brush control and aquatic weed control.

Cool Season Herbicides (cont.)

Herbicide	Brand Name(s)	Company	Uses
diphenamid	Enide	Nor-Am, Upjohn	Selective control of annual grasses and broadleaf weeds in bermudagrass, dichondra and around ornamentals.
DSMA	Methar 30 DSMA Liquid DSMA 81% Weed-E-Rad	W.A. Cleary Drexel Vertac Vineland	Selective post-emergennce control of sedges and grasses on turf and ditchbanks and storage yard.
diquat	Diquat	Valent	Aquatic weed control.
diuron	Karmex Dynex Diuron 80WP Urox	DuPont Vertac Drexel Hopkins	Generally used at high rates for non-selective total weed control in industrial sites.
endothall	Aquathol K Endothall	Pennwalt Pennwalt	Aquatic weed control and turf herbicide and dessicant.
EPTC	Eptam	ICI	Selective control of annual grassy weeds, nutgrass, and perennial weeds.
ethofumesate	Prograss	Nor-Am	For control of *Poa annua* and white clover in fairways.
fosamine	Kernite	DuPont	Brush control.
flurprimidol	Cutless	Elanco	Growth regulator that suppresses annual bluegrass.
fluazifop-butyl	Fusilade	ICI Americas	Selective post-emergence control of grassy weeds in ornamentals.
fluridone	Sonar	Elanco	Broad spectrum herbicide for submersed and emersed aquatic weeds.

Cool Season Herbicides (cont.)

Herbicide	Brand Name(s)	Company	Uses
glyphosate	Rodeo	Monsanto	For control of emerged aquatic weeds and broad leaf weeds in or near aquatic sites, such as ditchbanks.
glyphosate	Roundup	Monsanto	Non-selective, short-term herbicide for turf renovation and total weed control along fences and plant beds.
imazaquin	Image	American Cyanamid	Experimental herbicide for turf
imazapyr	Arsenal	American Cyanamid	Broad spectrum systemic industrial herbicide
linuron	Lorox	DuPont	Short-term control of annual weeds in roadsides and fence rows.
mefluidide	Embark	PBI Gordon	Grown regulator that suppresses *Poa annua.*
metham	Vapam	ICI	Preplant soil fumigant killing weeds, weed seed, insects and fungi.
methyl bromide	Dowfume	Dow	Fumigant for pre-plant control. Also kills weed seed.
metribuzin	Sencor	Mobay	Post-emergence control of goosegrass in warm-season turf.
MCPP	MCPP Mecomec MCPP Chipco Turf Herbicide	Fermenta PBI Gordon WA Cleary Rhone Poulenc	Selective broadleaf weed control in turf. Often combined with other herbicides.

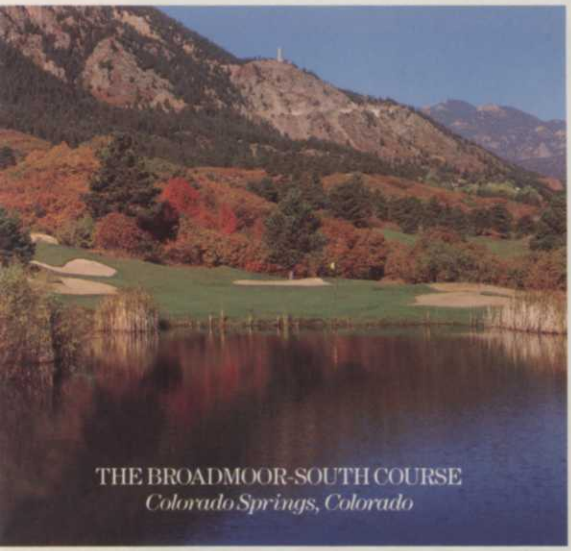
Cool Season Herbicides (cont.)

Herbicide	Brand Name(s)	Company	Uses
MSMA	Daconatel Broadside Ansar Weed-Hoe	Fermenta Vertac Drexel Vineland	Post-emergence selective control of crabgrass and broadleaf weeds in turf. Also, grassy weed control in ditchbanks, roadsides, industrial areas.
napropamide	Devrinol	ICI	Selective control of weeds in ornamental beds and containers. Experimental combination with Betasan for season-long crabgrass control in turf.
oryzalin	Surflan	Elanco	Pre-emergence control of weeds in established ornamentals and warm-season turf.
oxadiazon	Ronstar	Rhone Poulenc	Pre-emergence control of weeds in ornamentals and turf.
oxyfluorfen	Goal	Rohm & Haas	Selective control of weeds in ornamentals.
paraquat	Paraquat	Valent	Non-selective control of weeds in rights-of-way, industrial areas and fencerows.
pendimethalin	Proturf Weedgrass Control Pre-M	Lesco	Pre-emergence turf herbicide for control of grassy and broadleaf weeds.
picloram	Tordon	Dow	Systemic, long-term killer of woody plants and broadleaf weeds.
prometon	Pramitol	Ciba Geigy	Non-selective herbicide with long residual for industrial weed control.

Cool Season Herbicides (cont.)

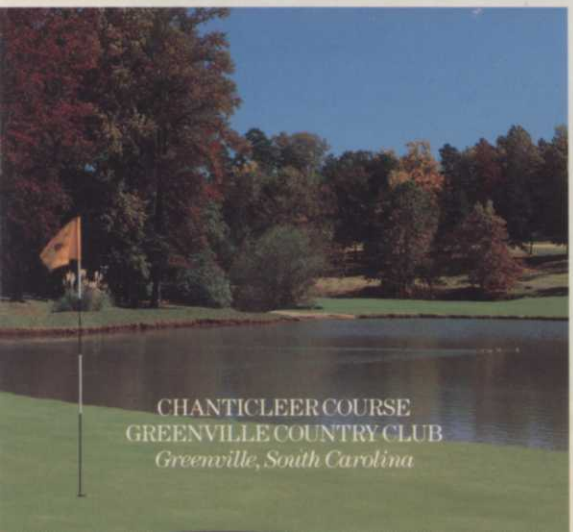
Herbicide	Brand Name(s)	Company	Uses
pronamide	Kerb	Rohm & Haas	*Poa annua* control in warm-season grasses. Also weed and grass control around woody ornamentals and Christmas trees.
sethoxydim	Poast	BASF	Post-emergence control of grassy weeds around broadleaf ornamentals.
siduron	Tupersan	DuPont	Pre-emergence control of annual grasses in newly seeded turf areas.
simizine	Princep	Ciba Geigy	Selective control of annual grasses and broadleaf weeds in established bermudagrass. Also, used in industrial and aquatic weed control.
sulfometuron-methyl	Oust	DuPont	Non-selective industrial and selective in bermudagrass.
tebuthiuron	Spike	Elanco	Brush control and total vegetation control in non-crop areas.
trifluralin	Treflan	Elanco	Selective pre-emergence weed control in established ornamentals and under asphalt.
triclopyr	Garlon	Dow	Systemic control of woody plants in rights-of-way and industrial sites.
2,4-D	2,4-D	Dow Fermenta Rhone Poulenc Vertac	Selective control of weeds in turf and numerous other areas. Usually mixed with other herbicides.
Vorlex	Vorlex	Nor-Am	Preplant fumigant. Broadleaf weed control in established turf.

We have our product

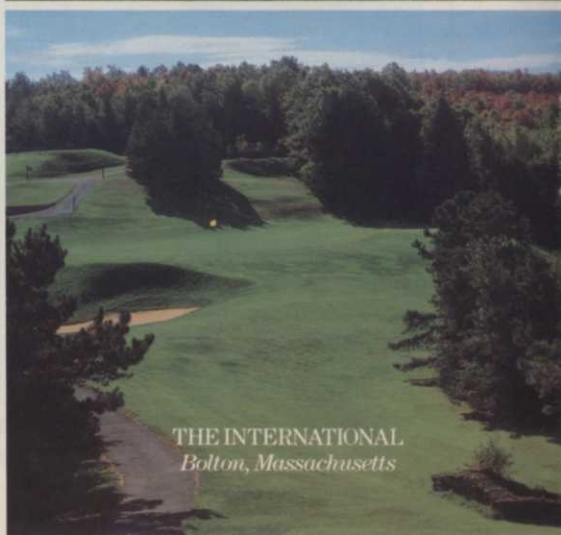


THE BROADMOOR-SOUTH COURSE
Colorado Springs, Colorado

NCR COUNTRY CLUB
Dayton, Ohio



CHANTICLEER COURSE
GREENVILLE COUNTRY CLUB
Greenville, South Carolina



THE INTERNATIONAL
Bolton, Massachusetts

grounds for claims.

You've heard it before. "This stuff will get rid of your Poa annua. Blah, blah, blah, blah."

Well, Scotts® TGR® Poa Annua Control *will* help you get rid of your Poa. And we've got grounds to prove it.

Golf courses with tough Poa annua problems. And demanding superintendents. Over 2,000 courses, all over the country, are now using it successfully in their maintenance programs.

The result? Scotts TGR Poa Annua Control has lived up to its claims.

That's because Scotts patented TGR formulation contains paclobutrazol and is the only controlled-release, fertilizer-based Poa control product. The only product that halts the growth of Poa, then encourages the growth of desirable grasses to overtake it.

And since Scotts TGR Poa Annua Control is dry-applied, you get more even coverage, and less potential for volatility and chemical breakdown. So you can be assured of safe consistent results when used as directed.

Your Scott's Tech Rep can give you more facts and figures. Or you can just call us at 1-800-543-0006.

The only holes in our claims have flags in them.

Scotts ProTurf.

TGR® Poa Annua Control

HAZELTINE NATIONAL GOLF CLUB
Chaska, Minnesota

SCIOTO COUNTRY CLUB
Columbus, Ohio

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Circle No. 805 on Reader Inquiry Card

WARM-SEASON

by Tim Murphy, Univ. of Georgia

Warm-Season Turfgrass Tolerance to Pre-Emergence Herbicides

	TURFGRASSES				
Herbicide	**Bahia-grass**	**Bermuda-grass**	**Centipede-grass**	**St. Augustine-grass**	**Zoysia grass**
(PRE-EMERGENCE)					
atrazine[1]	NR	T(D)	T	T	I
benefin	T	T	T	T	T
benefin + oryzalin	T	T	T	T	T
benefin + trifluralin	T	T	T	T	T
bensulide	T	T	T	T	T
bensulide + oxadiazon	NR	T	NR	NR	T
DCPA	T	T	T	T	T
ethofumesate[2]	NR	T(D)	NR	NR	NR
fenarimol	—	T	—	—	—
napropamide	T	T	T	T	NR
oryzalin	T	T	T	T	T
oxadiazon	NR	T	NR	T	T
pendimethalin	T	T	T	T	T
pronamide	NR	T	NR	NR	NR
simazine	NR	T	T	T	T

[1]When dormant, bermudagrass and zoysiagrass have good tolerance to atrazine.
[2]Ethofumesate is labeled for use on dormant bermudagrass that is overseeded with perennial ryegrass.
T = Tolerant at labeled rates; I = Intermediate tolerance, NR = Not registered for use on this turfgrass.

Shinnecock Hills Golf Club, Southampton, New York

Southern Hills Country Club, Tulsa, Oklahoma

Oak Tree Golf Club, Edmond, Oklahoma

Medinah Country Club, Medinah, Illinois

Another banner year for Betasan.

Once again, most of the country's top courses chose BETASAN.

Perhaps that's because top superintendents know that BETASAN® herbicide is more effective, safer and longer lasting than all other crabgrass controls, including Dacthal* and Team.**

Or, maybe the reason is Betasan is the only preemergent crabgrass control that's safe for bentgrass and all other turfgrasses, including established bluegrass, fescue, perennial, annual rye, bermudagrass, Zoysia, bahia, centipede and St. Augustine.

Either way, for over 20 years Betasan has been earning the trust of the most demanding and knowledgeable golf course superintendents in the country.

Isn't it time you experienced the same confidence?

BETASAN is available in liquid formulation, as well as granular, to match any application need you may have.

For more information contact your local supplier, or call ICI Americas at 1-800-759-2500.

BETASAN

Trusted most by the best

ICI

*Dacthal is a registered trademark of Fermenta Corp.
**Team is a registered trademark of Elanco.
BETASAN is also marketed professionally under the trade names Benasumec, Pre-San and Lescosan

Circle No. 802 on Reader Inquiry Card

Warm-Season Turfgrass Tolerance to Post-Emergence Herbicides

Herbicides	TURFGRASSES				
	Bahia-grass	Bermuda-grass	Centipede-grass	St. Augustine-grass	Zoysia-grass
(POST-EMERGENCE)					
asulam	NR-S	T[1]	NR-S	T	NR-I
atrazine	NR-I	T(D)	T(D)	T	I
bentazon	T	T	T	T	T
bromoxynil	T	T	T	T	T
2,4-D	T	T	S-I	S-I	T
2,4-D + dicamba	T	T	S-I	S-I	T
2,4-D + dichlorprop	T	T	S-I	S-I	T
2,4-D + mecoprop	T	T	S-I	S-I	T
2,4-D + mecoprop + dicamba	T	T	S-I	S-I	T
2,4-D + mecoprop + dichlorprop	T	T	I	I	T
dicamba	T	T	I-T	S-I	T
DSMA, MSMA	S	T	S	S	I
glyphosate[2]	NR-S	T(D)	NR-S	NR-S	NR-S
imazaquin	—	T	T	T	T
MCPA + MCPP + dichlorprop	T	T	I	I	T
MCPP + 2,4-D + dicamba	T	T	I	I	T
MCPP	T	T	S-I	S-I	T
metribuzin	NR-S	T	NR-S	NR-S	NR-S
pronamide	NR	T	NR	NR	NR
sethoxydim	NR-S	NR-S	T	NR-S	NR-I

[1] Asulam is labeled for use only on 'Tifway' (419) bermudagrass.
[2] Bermudagrass is tolerant to glyphosate when completely dormant.
T = Tolerant at labeled rates; I = Intermediate tolerance, use at reduced rates; S = Sensitive, do not use this herbicide; NR = Not registered for use on this turfgrass.

Common and Trade Names of Warm-Season Turfgrass Herbicides (cont.)

Common Name	Company	Trade Name and Formulation[1]
asulam	Rhone-Poulenc	Asulox 3.34 lbs./gal.
atrazine	Royalgard Ciba-Geigy	Purge 4 lbs./gal. Aatrex 4L, 90DG, 80W
benefin	Elanco Lesco	Balan 2.5G, 85DG 2.5 Benefin Granular (2.5G)
benefin + oryzalin	Elanco	XL 2G
benefin + trifluralin	Elanco	Team 2G
bensulide	ICI Royalgard PBI/Gordon Lesco	Betasan 2.9E, 4E, 3.6G, 7G, 12.5G Roysan 4E, 12.5G Betamec 4LF Lescosan 4E, 7G
bensulide + oxadiazon	Scotts	Goosegrass/Crabgrass Control 6.5G
bentazon	BASF	Basagran - 4lbs./gal.
bromoxynil	Rhone-Poulenc Lesco	Buctril 2 lbs./gal., Buctril 4EC, Brominal 2 lbs./gal., ME4 Brominal Brominal 2 lbs./gal.
2,4-D	Interag, Lesco, Fermenta Others	Numerous trade names and formulations are available
2,4-D + dicamba	Rhone-Poulenc Lesco PBI/Gordon	Weedone Super D Pro Amine Eight-One Selective Herbicide Phenaban 801
2,4-D + dichlorprop	Rhone-Poulenc	Weedone DPC Amine, Weedone DPC
2,4-D + mecoprop	Lesco Rhone Poulenc PBI/Gordon	Lescopar Turf Kleen Phenomec 2+1
2,4-D + mecoprop + dicamba	Lesco	Three-way
2,4-D + mecoprop + dichlorprop	Riverdale	Weedestroy Triamine

[1]Numeral refers to percent or pounds of active ingredient.

continued . . .

Introducing Cutless.®

A new kind of turf growth regulator that gives your course a bottom line boost:

More playability.

This is where perfect lies start on your fairway. New Cutless 50W from Elanco.

Unlike other turf growth regulators, new Cutless doesn't stop the development of warm and cool season turfgrass. Instead, it reduces or slows your turfgrass's growth rate by shortening the internodes of the growth stem with no adverse effects on their roots. The result is improved turf quality and more playable fairways.

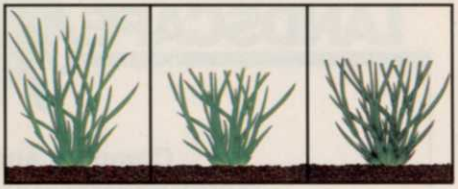
With Cutless, your turfgrass appears thicker and stronger for a denser, more consistent playing surface. Golf balls just naturally sit up better.

Cutless also reduces your water use, resulting in less turf wilt. And lower irrigation costs.

But Cutless does more than that. Much more. It also gives your turf a rich, darker green color.

Because Cutless-treated grass grows at a slower rate, there's also a dramatic reduction in clippings. Up to 50% less. With less mowing frequency. Also up to 50% less. You not only save time and labor costs, you can also manage your hard-to-mow areas more efficiently.

Here's another added benefit with Cutless. As your turfgrass grows up thicker and more competitive, there's less room for troublesome weeds to interfere. Cutless also helps crowd out *Poa annua* for conversion to a more desirable turfgrass such as bentgrass.



1. Sprig of grass in normal state.
2. Seven to 10 days after Cutless application, mowed sprig sometimes exhibits slight discoloration of treated area and leaf tip browning.
3. Growth reduction peaks between third and eighth weeks, accompanied by darker green coloration and increased tillering.

Don't just take our word for Cutless. Take it from Scott Niven:

Scott Niven
Superintendent, Stanwich Club
Greenwich, Conn.

"I've reduced clippings 30 to 50% when we mow fairways. My guys don't have to empty the baskets as much, so we save time and money on labor. But I think the best advantage is the reduction in the amount of water you have using Cutless. It's a marked difference.

"Initially, you get so little discoloration with Cutless that a golfer would never notice it. But after 4 weeks, the difference was between night and day on how dark green the Cutless turf was.

"Cutless helped us convert from 80% Poa annua *to over 95% bentgrass within five years. But I'm just as impressed with how Cutless creates a much thicker turf. It makes the grass as tough as nails, helps the ball sit up higher for our golfers."*

Find out more about giving your course more playability with Cutless. See your Elanco distributor. Or for a free brochure, call toll-free: **1-800-352-6776.**

Elanco Products Company
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Dept. EM-455, Indianapolis, IN 46285 U.S.A.
Cutless®—(flurprimidol, Elanco)

Circle No. 801 on Reader Inquiry Card

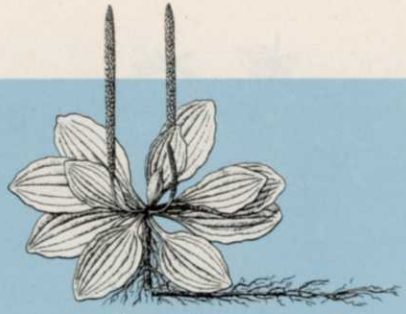
Common and Trade Names of Warm-Season Turfgrass Herbicides (cont.)

Common Name	Company	Trade Name and Formulation[1]
DCPA	Fermenta	Dacthal 75W
dicamba	Sandoz PBI/Gordon	Banvel 4 lbs./gal. Dicamba 4, 4 lbs./gal.
DSMA	Interag, Vineland, Others	Numerous trade names and formulations are available.
ethofumesate	Nor-Am	Prograss 1.5EC
fenarimol	Elanco	Rubigan 50W, 1AS
glyphosate	Monsanto	Roundup 4 lbs./gal.
imazaquin	Lesco	Image 1.5 lbs./gal.
MCPA	PBI/Gordon	MCPA 4 lbs./gal.
MCPA + MCPP	Riverdale	Weedestroy Triamine II
+ dichlorprop MCPP	Royalgard Rhone-Poulenc PBI/Gordon Lesco	Sabre Turf Herbicide MCPP 2 lbs./gal. Mecomec 4 4 lbs./gal. Lescopex 2.5 lbs./gal.
MCPP + 2,4-D + dicamba	PBI/Gordon	Trimec Southern
metribuzin MSMA	Mobay Fermenta, Platte, others	Sencor Turf 75W Numerous trade names and formulations are available.
napropamide	Lesco ICI	Devrinol 5-G Ornamental Devrinol 50WP, 5G
oryzalin	Elanco	Surflan 4AS
oxadiazon	Rhone-Poulenc	Ronstar 2G
pendimethalin	Lesco Scotts	PRE-M 60DG Southern Weedgrass Control 2.45G, Turf Weedgrass Control 1.71G, Weedgrass Control 60DG
pronamide	Rohm-Haas	Kerb 50W
sethoxydim	BASF	Poast 1.5 lbs./gal.
simazine	Ciba-Geigy	Princep 80W, 4L, 90DG, 4G

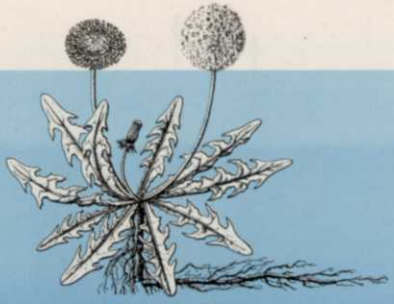
IDENTIFICATION OF SOME COMMON TURF WEEDS

O.M. Scott & Sons

Ground Ivy



Plantain



Dandelion

Spotted Spurge

Corn Speedwell

Clover

Common Chickweed

Ragweed

Purslane

Buckhorn

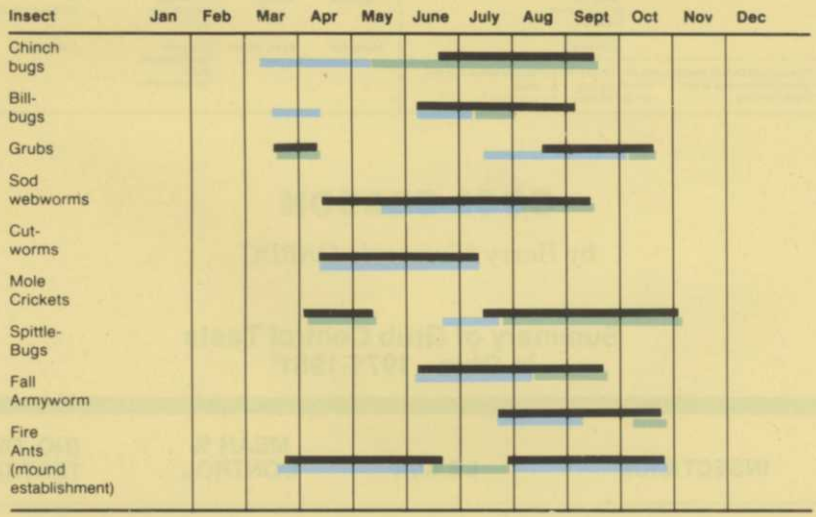
INSECT CONTROL

WARM-SEASON INSECT CONTROL

by Pat Cobb, Auburn University

Insect Calendar

*MONTHS DURING WHICH DAMAGE IS MOST LIKELY TO OCCUR (▬▬▬);
MONTHS WHEN INSECTICIDE TREATMENTS MAY BE RECOMMENDED
(▬▬▬ = 1ST CHOICE, ▬▬▬ = 2ND CHOICE)



*Timing of treatments varies from one area to another, and is considerably different in south Florida. Check with Extension Agents in your area and monitor pest populations to determine exact timing of controls.

Use Summary of Some Common Turf Insecticides*

Common Name	Trade Name	Major Uses	Primary Use Site ***
acephate	Orthene 75S	fire ants mole crickets	A, G, L, S
**bendiocarb	Turcam	grubs mole crickets	A, L
carbaryl	Sevin SL Sevimol	billbug (adults) cutworms fall armyworms green June beetle grubs grubs sod webworms	A, G, L, S
chlorpyrifos	Dursban	billbug (adults) chinch bugs cutworms fall armyworms fire ants sod webworms spittlebugs	A, G, L, S
diazinon	Diazinon	billbugs chinch bugs fall armyworms fire ants grubs sod webworms spittlebugs	L
**ethoprop	Mocap 5G	grubs mole crickets	A, G, L, S
isofenphos	Oftanol	fire ants grubs mole crickets	A, G, L, S
**isazofos	Triumph	chinch bugs mole crickets grubs	L (G&S in some states)
trichlorfon	Dylox, Proxol	cutworms fall armyworms grubs sod webworms	A, G, L, S

*Fire ant baits (Affirm, Amdro, Logic, Pro-Drone) are not included above, but may be used in non-crop areas)
**Restricted Use
***A – athletic turf L – lawns
G – golf courses S – sod farms

COOL-SEASON

by Harry Niemczyk, OARDC

Summary of Grub Control Tests in Ohio - 1971-1981[1]

INSECTICIDE	LB AI/A	MEAN % CONTROL	(NO. OF TESTS)[2]
ethoprop (Mocap)	5.0	83	(10)
isazofos (Triumph)	2.0	92	(20)
bendiocarb (Turcam)	2.0	83	(18)
isofenphos (Oftanol)	2.0	80	(37)
carbaryl (Sevin)	8.0	64	(14)
trichlorfon (Proxol)	8.0	81	(23)
diazinon	5.5	60	(16)
chlorpyrifos (Dursban)	4.0	43	(11)

1 Includes Japanese beetle, Cyclocephala spp., Phyllophaga spp. only.
2 Each test replicated 3 or 4x. Generally, treatments applied late summer or early spring. Irrigated (¼-½ inch) after application, thatch - ½ inch, readings taken ca. 4-8 weeks after treatment -H.D. Niemczyk & K.T. Power.

Insect Control

COOL SEASON*	LATE WINTER	SPRING (April-May)	SUMMER (June-Aug.)	FALL (Sept.-Oct.)
CHINCH BUGS	When summer damage is expected preventative application of liquid or granular Dursban (1 lb. Ai/acre) Triumph[1] (1 lb. Ai/acre) or Oftanol (2 lbs. Ai/acre) may be used as soon as the insects become active.	Preventative applications of insecticides should be completed by the first week in May.	Treat before injury is severe with Dursban (1 lb. Ai/acre), diazinon** (2.5-5.5 lbs. Ai/acre), or other labeled insecticides.	Treat if necessary, but generally infestation levels are not high enough to warrant using insecticides.
BILLBUGS	Same as for chinch bugs.	Same as for chinch bugs.	Treat infestations at same rates as grubs with Triumph[1] diazinon**, Turcam, Proxol or Sevin. Irrigate following application.	Treatment is usually not appropriate at this time.
GRUBS	Application of Oftanol (2 lbs. Ai/acre) during March may provide control of overwintered grubs. This may not provide control into late summer.	A single application of Oftanol (2 lb. Ai/acre) made in April may control overwintered grubs. Can also be controlled in May by spot or general treatment with Triumph[1] (2 lb. Ai/acre) Turcam (4 lb. Ai/acre) or Sevin (8 lb. Ai/acre). Golf course superintendents can use Mocap (5 lb. Ai/acre) or Sevin (6-8 lb. Ai/acre) to control green June beetle. Irrigate with application.	Existing infestations found in July or Aug. may be treated with Triumph[1], Proxol, Turcam, Oftanol, Sevin or Mocap (commercial turf only) at rates used in spring. Treat green June beetle with Sevin (6-8 lbs. Ai/acre).	Treatment can be made as late as Mid-September. Irrigate first if thatch or soil is dry.
SOD WEBWORMS	Treatment is not appropriate at this time.	When necessary, apply diazinon** (5 lb. Ai/acre) Triumph[1] (1 lb. Ai/acre) Dylox or Proxol (6-8 lb. Ai/acre). Orthene (1-3 lb Ai/acre).	Make application when larvae are present or two weeks after peak moth flight. Use Dursban (1 lb. Ai/acre), Triumph[1] (1 lb. Ai/acre), Diazinon** (5 lbs. Ai/acre), Sevin (6-8 lbs. Ai/acre) or Proxol (6-8 lbs. Ai/acre).	Larvae are small and cause little damage at this time. Treatment in September reduces population for next spring.
GREENBUGS	Treatment is not appropriate at this time.	Aphid numbers are too low to detect.	Use Orthene (l lb. Ai/acre) or Dursban (1 lb. Ai/acre) or diazinon** (2.5 lbs. Ai/acre).	Severe infestations may occur as late as December. Use the same insectides as in the summer.
BLACK TURFGRASS ATAENIUS	An application of Oftanol (2 lb. Ai/acre) in March may prevent summer infestations of larvae, but it's best to wait until April.	Application of Oftanol (2 lbs. Ai/acre) during April or May can prevent larval infestations during summer. Dursban (1-2 lbs. Ai/acre) applied to fairways in April also prevents infestations. Retreatment after 2 weeks may be necessary.	If preventative applications were not made, spot or generally treat with Triumph[1] (2 lbs. Ai/acre), Proxol (8 lbs. Ai/acre), Turcam (2-4 lbs. Ai/acre), Sevin (8 lbs. Ai/acre) or Mocap (5 lbs. Ai/acre), as needed.	Undeveloped larvae die with frost.
CUTWORMS	Treatment is not appropriate at this time.	The insecticides effective against sod webworm are also effective against cutworms. Apply late in the afternoon. Do not irrigate following liquid applications unless specified on label.	Use Orthene (1-3 lb. Ai/acre), Dursban (1 lb. Ai/acre), Triumph[1] (1 lb. Ai/acre), Proxol (8 lbs. Ai/acre) or Sevin (6-8 lbs. Ai/acre). Do not irrigate following liquid applications unless specified on label.	Same as for summer.
CLOVER MITES	Treatment is not appropriate at this time.	Liquid diazinon** (2.5 lbs. Ai/acre) or Dursban (1 lb. Ai/acre) may be used.	Treatment usually is not necessary.	Treat as needed with liquid diazinon** (2.5 lbs. Ai/acre) or Dursban (1 lb. Ai/acre).
WINTER GRAIN MITE	If needed, use spring treatment.	If treatment is necessary, use liquid diazinon** (2-3 lbs. Ai/acre) or Dursban (1 lb. Ai/acre). Avoid repeated use of Sevin.	Treatment is not appropriate, since mite is in egg stage.	Treatment is not appropriate since mite is in egg stage.

[1] For use only by commercial lawn pest control personnel except in states where Special Local Needs labeling permits use on golf course tees, greens and aprons, and on sod farms. A maximum of one application per year is permitted for the 2 lbs. Ai/acre rate. A maximum of two applications per year at least 60 days apart is permitted for the 1 lb. Ai/acre rate.
* See accompanying text for details; always follow label directions.
** Diazinon may not be used on golf courses or sod farms.

DISEASE CONTROL

WARM-SEASON

by Don Blasingame, Mississippi St. Univ.

Fungicide Directory

Common Name	Some Trade Names**	Brown Patch	Dollar Spot	Gray Leaf Spot	Melting Out	Pythium Blight	Rusts	Spring Dead Spot
Anilazine	Dyrene, ProTurf fungicide III		●		●		●	
Benomyl	Benlate, Tersan 1991	●	●					●*
Chloroneb	Terraneb SP, ProTurf Fungicide II					●		
Chlorothalonil	Daconil 2787 ProTurf 101V	●	●	●	●		●	
Ethazole	Koban 30, Terrazole					●		
Fenarimol	Rubigan	●	●					●
Iprodione	Chipco 26019 ProTurf, Fungicide VI	●	●		●			
Mancozeb	Fore, Tersan LSR Many Others	●			●		●	
Metalaxyl	Subdue					●		
PCNB (quintozene)	Terraclor Turfcide	●	●		●		●	
Propamocarb	Banol					●		
Propiconazole	Banner	●	●				●	●*
Thiophanate-ethyl	Cleary 3336	●	●		●			
Thiophanate-methyl	Fungo 50, Proturf Systemic Fungicide	●	●					
Thiophanate-methyl + Mancozeb	Duosan	●	●		●		●	
Thiram	Thiram, Tersan 75	●	●					
Triadimefon	Bayleton, ProTurf Fungicide 7	●	●				●	
Vinclozolin	Vorlan		●		●			

* Label approved only in selected states. ** Combination of fungicide + fertilizer are not included.
No endorsement of named products by author is intended, nor is criticism implied for products not mentioned.

COOL-SEASON

by Bill Shane, Ohio State Univ.

Cool-Season Turf Diseases, Turf Disease and Controls

DISEASE	SEASON AND/OR SUSCEPTIBLE TURFGRASS[2]	CULTURAL	FUNGICIDE/NEMATICIDE ACTIVE INGREDIENT[4]
Algae	All turfgrasses	Reduce shade. Avoid excessive fertilization. Improve soil drainage.	Mancozeb
Anthracnose ***(Colletotrichum graminicola)***	July-August; ANNUAL BLUEGRASS, BENTGRASS, Fine Fescue	Fertilize and water to maintain vigor. Syringing may help to prevent stress.	Benomyl[3], Triadimefon Thiophanate-Methyl[3] Propiconizol, Fenarimol, Chlorothalonil
Brown Patch	See Rhizoctonia blight		
Dollar Spot ***(Lanzia* and *Moellerodiscus*** **spp., formerly** ***Sclerotinia homeocarpa)***	Late June-Oct. BENTGRASSES BLUEGRASSES Fescues Ryegrasses	Avoid nitrogen deficiency. Remove dew from greens by mowing, dragging with a hose or pole. Choose more resistant grass varieties.	Chlorothalonil, Cadmium[3], Benomyl[3], Anilizine[3], Fenarimol, Iprodione[3], Propiconizol, Thiophanate- ethyl[3], Thiophanate-methyl[3], Thiram, Triadimefon, Vinclosolin[3]
Fairy Rings (Basiodomycete soil fungi)	April-October All turfgrasses	Remove infested sod and soil, replace with clean soil and reseed or sod. Improve water penetration. Increase N fertilization.	Methyl bromide or Formaldehyde fumigation will eradicate fungus but will also kill turf
Fusarium Blight[5] ***8Fusarium poae, F. vulmorum, F. crookwellense)***	July-August Bluegrasses Bentgrasses Fescues	Reduce heat stress during dry periods by light, frequent watering. Do not cut Kentucky bluegrass or fescues under 2 inches. Reduce excessive thatch (over ¾ inch).	Triadimefon, Fenarimol Benomyl[3], Iprodione, Thiophanate-methyl[3], Thiophanate-ethyl[3]
Fusarium Patch (Pink Snow Mold) (*Fusarium nivale*)	Nov.-April Bluegrasses Bentgrasses Fescues Ryegrasses	Avoid late fall fertilizing. Rake leaves and cut short. Control drifting snow.	Triadimefon, Benomyl[3], Fenarimol, Iprodione[3], Mancozeb, Mercury chlorides, Pentachloronitrobenzene, Thiram, Thiophanate-methyl[3], Vinclozolin
Grey Snow Mold	see Typhula blight		
Leafspot/Blight /Melting out (*Drechslera* & *Bipolaris* ssp.)	Leafspot: Spring & fall; Blight & Melting out: June-Aug. KENTUCKY BLUEGRASS BENTGRASSES FINE FESCUE, ryegrasses, tall fescue	Remove clippings. Raise cutting height. Avoid excessive nitrogen. Avoid light, frequent watering.	Cycloheximide, Iprodione, Chlorothalonil, Mameb, Nancozeb, Vinclozolin, Pentachloronitrobenzene
Nematodes	All turfgrasses		Fenamiphos, Ethoprop

1 Before using any pesticide, read and follow label instructions.
2 Grass types listed in capital letters have been observed to be especially susceptible to the pathogen.
3 Continued or sole use of these materials may favor build-up or resistant fungal population.
4 Products containing these active ingredients are listed in the following table. Read the product label to see if it is labelled for the disease of concern. Follow all label instructions.
5 Necrotic ring spot and summer patch are known to cause symptoms once attributed solely to Fusarium blight.
6 Pink patch disease was recently found to be a disease distinct from red thread. Thus, there are few fungicides specifically registered for control of this disease at this time.
7 Another fungus, *Rhizoctonia zeae*, is also capable of causing brown patch-like symptoms on bluegrass and bentgrass. Benzimidazole type (Tersan 1991, Benomyl, Fungo 50, Cleary 3336) are not effective against this pathogen.

continued . . .

Cool-Season Turf Diseases, Turf Disease and Controls (cont.)

DISEASE	SEASON AND/OR SUSCEPTIBLE TURFGRASS[2]	CULTURAL	FUNGICIDE/NEMATICIDE ACTIVE INGREDIENT[4]
Necrotic Ring Spot[5] (*Leptosphaeria korrae*)	Spring & fall KENTUCKY BLUEGRASS, annual bluegrass ryegrasses	Avoid low mowing heights (below 2 inches). Reduce excessive thatch (over ¾ inch). Use Kentucky bluegrass and perennial ryegrass mixtures.	Fenarimol, Propiconizol
Pink Patch[6] (*Limonomyces roseipellis*)	Spring & fall bentgrass, FINE FESCUE, PERENNIAL RYEGRASS	Follow balanced fertilization program.	Cadmium, Mancozeb
Pink Snow Mold	see Fusarium patch		
Powdery Mildew (*Erysiphe graminis*)	July-Oct. KENTUCKY BLUEGRASS, fine fescue	Reduce shade. Increase air circulation by removing surrounding vegetation.	Triadimefon, Fenarimol, Propiconizol
Pythium Blight (*Pythium aphanidermatum, P. graminicola*)	June-Sept. BENTGRASSES, ANNUAL BLUEGRASS, PERENNIAL RYEGRASS, Kentucky bluegrass	Improve soil drainage. Increase air circulation by removing surroundign vegetation. Avoid mowing wet grass. Avoid excess watering.	Chloroneb, Etridiazole, Propamocarb, Metalaxyl, Fosetyl-Al, Mancozeb
Red Leaf Spot (*Drechslera erythrospila*)	June-Sept. BENTGRASSES	Remove clippings. Fertilize to maintain vigor.	Iprodione, Anilizine
Red Thread (*Laetisaria fuciformis*)	All seasons PERENNIAL RYEGRASS, FINE FESCUE, bentgrass, annaul bluegrass, Kentucky bluegrass	Follow balanced fertilization program.	Vinclozolin, Cadmium, Chlorothalonil, Thiophanate-ethyl, Thiophanate-methyl, Nancozeb, Triadimefon Propiconizole
Rhizoctonia Blight (Brown patch) (*Rhizoctonia solani* = *Thanatephorus cucumeris*)[7]	July-August BENTGRASS, ANNUAL BLUEGRASS, TALL FESCUE, Kentucky bluegrass, fine fescue	Avoid excess nitrogen fertilization. Increase air circulation, by removing surrounding vegetation. Avoid excessive watering.	Anilizine, Chlorthalonil, Mancozeb, Benomyl[3] Maneb, Propiconizole, Pentachloronitrobenzene, Triadimefon, Thiophanate-methyl[3], Thiophanate-ethyl[3], Iprodione
Rust (*Puccinia spp.*)	August-Oct. PERENNIAL RYEGRASS, KENTUCKY BLUEGRASS	Avoid nitrogen deficiency. Use resistant varieties of Kentucky bluegrass and perennial ryegrass.	Mancozeb, Propiconizole, Cycloheximide, Chlorothalonil, Triadimefon, Fenarimol
Slime Molds (*Myxomycete9*	August-Sept. All Turfgrasses	Removing mechanically by mowing or raking.	Zineb, Mancozeb
Snow Mold	see Fusarium Patch and Typhyula Blight		

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continued . . .

Cool-Season Turf Diseases, Turf Disease and Controls (cont.)

DISEASE	SEASON AND/OR SUSCEPTIBLE TURFGRASS[2]	CULTURAL	FUNGICIDE/NEMATICIDE ACTIVE INGREDIENT[4]
Strip Smut (*Ustilago striiformis*)	Spring & fall KENTUCKY BLUEGRASS, Bentgrasses	Avoid drought stress. Avoid excess nitrogen.	Propiconizole, Triadimefon, Benomyl, Thiophanate-ethyl *Notes.* Apply extra water for crown penetration. Apply in late fall or early spring
Summer Patch[5] (*Magnaporthe ssp.*, formerly *Phiaophora graminicola*)	June-August ANNUAL BLUEGRASS, KENTUCKY BLUEGRASS	Avoid low mowing height. Reduce excessive thatch. Light, frequent watering during dry periods to reduce heat stress. Use slow-release nitrogen to avoid nutrient depletion. Use Kentucky bluegrass and perennial ryegrass mix.	Fenarimol, Triadimefon; Materials must be applied preventatively.
Take-all Patch *(Ophiobolus patch) (Gaeumannomyces graminis var avenae)*	Spring & fall BENTGRASS	Avoid topdressing soil with pH greater than 6.0 Avoid use of lime, especially small particle type, where take-all is a problem. Use ammonium chloride, or second best, ammonium sulfate fertilizers.	PMA (not labelled for this disease, but may be effective)
Typhula Blight (Grey Snow Mold) (*Typhula spp.*)	Nov.-April fine fescue, BENTGRASS, ANNUAL BLUEGRASS, Kentucky bluegrass, tall fescue, perennial ryegrass	Avoid heavy fall nitrogen promoting late lush growth. Rake leaves and cut short. Control drifting snow.	Triadimefon, Cadmium, Chloroneb, Anilizine, Pentachloronitrobenzene, Mercury Chlorides, Thiram
Yellow Patch (*Rhizoctonia cerealis*)	Spring & fall Bentgrasses Bluegrasses	Reduce excessive thatch. Avoid excessive watering.	None
Yellow Tuft (Downy mildew) (*Sclerophthora spp.*)	Spring & fall Bentgrass		Metalaxyl

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FERTILIZER

TURF FERTILIZATION

by William Daniel, Purdue University

Formulations of Turf Fertilizers

Nitrogen	No Phosphorous	High N, Low P Medium K	Similar P and K	Other
6-4-0	16-0-30	12-4- 8	12-12-12	8- 4- 4
21-0-0-24S	20-0-10	19-5- 9	14- 3- 3	8-22-16
30-0-0	20-0-16	20-3- 8	16- 8- 8	9- 6-18
31-0-0	28-0- 9	24-2- 9	20- 8- 8	10-15-30
32-0-0-30S	28-0-12	24-4-12	20-20-20	13-25-12
33-0-0	30-0-10	28-7-14	24- 3- 3	16-21- 3
38-0-0	33-0- 5	32-3-10		19-26- 3
41-0-0	33-0-10	34-3- 7		
45-0-0		34-5-10		
55-0-0				
66-0-0				

* More than 100 formulations available in Indiana-1986

Nitrogen Requirements

Species	Growing Months	Nitrogen per seasons lbs/1000 sq. ft.	Variation in Management
Cool season:			
sheeps & hard fescue	4-8	0-3	low maintenance, roughs
red fescues	4-8	1-3	low maintenance to good care
bentgrasses	4-8	1-4	medium care, lawn, fairways
bentgrass, greens	5-12	2-10	clippings removed, forced growth
Kentucky bluegrasses	5-12	2-4	clippings remain, coastal area
Warm season:			
bermudagrass, greens	8-12	8-20	may rest over winter
bermudagrass, overseeded	10-12	12-20	nurtured all season
bermudagrass, fairways & tees	5-12	4-9	good management
common bermuda	7-12	2-8	most variable
zoysia	6-10	1-6	adequate cover
St. Augustine, bahia	10-12	2-8	warm area, lawns

by Roger Funk, Richard Rathgens, The Davey Company

Essential Elements

Element	Percent of Plant Tissue**	Element	Percent of Plant Tissue**
Oxygen	45	Sulfur	0.1
Cargbon	45	Iron	0.01
Hydrogen	6	Chlorine	0.01
Nitrogen	1.5	Manganese	0.005
Potassium	1.0	Zine	0.002
Calcium	0.5	Boron	0.002
Phosphorus	0.2	Copper	0.0006
Magnesium	0.2	Molybdenum	0.00001

* Adapted from: B.R. Stout, 1961. Proceedings of 9th Annual California Fertilizer Conference, pp 21-23.

** These percentages vary from different species and for the same species grown under different conditions.

Forms Available to Green Plants

Elements		Available forms	Elements		Available forms
1. Macronutrients			2. Micronutrients		
Nitrogen	(N)	NO_3—, NH_4+, Urea (some)	Iron	(Fe)	Fe++, Fe+++
Phosphorus	(P)	HPO_4——, H_2PO_4—	Manganese	(Mn)	Mn++, Mn+++
Potassium	(K)	K+	Copper	(Cu)	Cu+, Cu++
Calcium	(Ca)	Ca++	Zinc	(ZN)	Zn++
Magnesium	(Mg)	Mg++	Boron	(B)	BO_3———
Sulfur	(S)	SO_4——, SO_3—	Molybdenum	(Mo)	MoO_4——
			Chlorine	(C)	Cl—

Salt Indexes

Fertilizer	Formula	%N	$\%P_2O_5$	$\%K_2O$	Salt Index	Partial** Salt Index
Nitrogen sources						
Ammonium nitrate	NH_4NO_3	35.0	—	—	104.7	2.99
Ammonium sulfate	$(NH_4)_2SO_4$	21.2	—	—	69.0	3.25
Sodium nitrate	$NaNO_3$	16.5	—	—	100.0	6.06
Potassium nitrate	KNO_3	13.8	—	—	73.6	5.34
Urea	H_2NCONH_2	46.6	—	—	75.4	1.62
Natural organic		5.0	—	—	3.5	0.70
Monoammonium phosphate	$NH_4H_2PO_4$	12.2	—	—	29.9	2.45
Diammonium phosphate	$(NH_4)_2HPO_4$	21.2	—	—	34.2	1.61
Phosphorus Sources						
Superphosphate	$Ca(H_2PO)_2 + CaSO_4$	—	20.0	—	7.8	0.39
Triple superphosphate	$Ca(H_2PO_4)_2$	—	48.0	—	10.0	0.21
Monoammonium phosphate	$NH_4H_2PO_4$	—	61.7	—	29.9	0.49
Diammonium phosphate	$(NH_4)_2HOP_4$	—	53.8	—	34.2	0.64
Monopotassium phosphate	KH_2PO_4	—	52.2	—	8.4	0.16
Potassium Sources						
Potassium chloride	KC1	—	—	60.0	116.3	1.94
Potassium nitrate	KNO_3	—	—	46.6	73.6	1.58
Potassium sulfate	K_2SO_4	—	—	54.0	46.1	0.85
Monopotassium phosphate	KH_2PO_4	—	—	34.6	8.4	0.24

* Adapted from: Rader, Jr., L.F., L.M. White and C.W. Whittaker, 1943. The Salt Index—A Measure of the Effect of Fertilizers on the Concentration of the Soil Solution. Soil Science Volume 55, pp 201-218.

** Calculated per unit of N, P_2O_5, or K_2O.

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